Novel coronavirus 2019 testing in women attending routine antenatal care: a cross-sectional study

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Abstract

Objective: Universal screening has been proposed as a strategy to identify asymptomatic individuals infected with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and mitigate transmission. We aimed to investigate the rate of positive tests among pregnant women attending routine antenatal care. Design: Cross-sectional prevalence study. Setting: Antenatal clinic at three maternity hospitals (one tertiary referral hospital and two secondary maternities) in Melbourne, Australia. Population: Asymptomatic pregnant women attending routine antenatal care and pregnant women undergoing testing with symptoms of possible coronavirus disease. Methods: SARS-CoV-2 testing was offered to all pregnant women attending face-to-face antenatal visits and to those attending the hospital with symptoms of possible coronavirus disease, between 6th and 19th of May 2020. Testing was performed by multiplex-tandem polymerase chain reaction (PCR) on combined oropharyngeal and nasopharyngeal swabs. Main Outcome Measures: Proportion of positive SARS-CoV-2 tests. Results: SARS-CoV-2 testing was performed in 350 women, of whom 19 had symptoms of possible COVID-19. The median maternal age was 32 years (IQR 28 to 35 years), and the median gestational age at testing was 33 weeks and four days (IQR 28 weeks to 36 weeks and two days). All 350 tests returned negative results ($p = 0\%$, 95% CI 0 to 0.86%). Conclusion: The rate of asymptomatic coronavirus infection among pregnant women in Australia during the study period was negligible, which reflected reassuringly low levels of community transmission.

Introduction

Since the first report of an outbreak of pneumonia cases caused by a novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in December 2019 in Wuhan, China, the disease has rapidly spread around the world and was defined as a pandemic by the World Health Organization on the 11th of March 2020. As of 29thof June, more than ten million infections and over 500,000 deaths related to coronavirus disease (COVID-19) have been confirmed worldwide[1].

Different countries have adopted varying degrees of physical distancing and mitigation strategies with diverse impacts on their transmission rates, death toll and economies[2, 3]. It has been proposed that universal testing with the isolation of cases and contact tracing could reduce the prevalence of the disease and end the pandemic[4]. In Australia, restriction measures were first implemented on the 23rd of March (with the closure of bars, clubs, cinemas, places of worship, casinos and gyms), and two days later the country closed its borders. As part of the mitigation strategy, the Victorian state government implemented a screening "blitz" in the last week of April. The purpose of this was to screen a large number of people and therefore allow for contact tracing and physical isolation of positive asymptomatic individuals prior to easing of restrictions. After a peak in the number of cases in the end of March both in Australia and the state of Victoria, a steep decline in the daily number of new cases became evident, and restrictions have gradually and progressively been eased since the second half of May. Nevertheless, estimates of the infection rates among asymptomatic individuals in Australia are currently unavailable, and whether universal screening is necessary in low disease prevalence settings is unclear.

Preliminary data suggests that pregnant women are not at increased risk of severe disease and its complications compared to the general population, nor is there convincing evidence of vertical transmission[5, 6]. However, within the pandemic context, pregnancy represents a unique situation as women have multiple interactions with the health care system and most are ultimately admitted to hospital for childbirth. Therefore, it is possible that pregnant women may be a source of infection to others who they encounter during their frequent attendance to healthcare facilities, so it is vital to understand the rates of asymptomatic infection in this population.

This study aims to assess the prevalence of SARS-CoV-2 positive tests among pregnant women attending routine antenatal care within a defined study period during the coronavirus disease pandemic in Victoria, Australia.

Methods

We performed a cross-sectional study at Victoria's largest maternity service, Monash Health, that provides birthing services across three hospitals in southeast metropolitan Melbourne, Victoria, Australia. There are about 10,000 births in the service each year (nearly one in seven of all Victorian births).

During the two-week period from 6th to 19th May 2020, inclusive, women attending routine antenatal visits were offered SARS-CoV-2 testing. We also included pregnant women who had testing in other sectors of the hospital (maternity ward, birth suite, pregnancy assessment unit, or COVID-19 screening clinic) with possible symptoms of the disease. In the weeks that preceded routine screening, we had adopted the following strategies in our three maternity hospitals to reduce exposure of patients, relatives and staff: a significant number of antenatal consultations (approximately 60%) were shifted to a telehealth model, with face-to-face appointments reserved for visits at 28, 36 and 40 weeks of pregnancy, or when deemed necessary by the attending health professional; all women were routinely asked about recent travel, known contacts and the presence of recognised COVID-19 symptoms; if symptoms were present, women were advised to attend the COVID-19 screening clinic and not to attend their antenatal appointment; all women attending the clinic or the hospital had body scanning temperature check on arrival; no support persons were allowed during clinic consultations or ultrasound examinations, and only one support person was allowed during labour and birth; and all health care professionals attending births wore protective equipment (PPE) after appropriate training.

Combined oropharyngeal and nasopharyngeal swabs were collected as recommended[7] and according to national guidelines[8] using FLOQSwabs® and transported in UTM medium (Copan, Brescia, Italy) by a trained health professional (nurse or midwife) wearing appropriate PPE consisting of a gown, nonsterile gloves, eye protection and a protective mask. SARS-CoV-2 testing was then performed utilising multiplex-tandem polymerase chain reaction (PCR, AusDiagnostics, Mascot, Australia), an assay with demonstrated high sensitivity and specificity (>99.9%)[9].

In the screening period, additional data were collected regarding maternal age, weight, height, parity, gestational age, recent overseas travel since the beginning of the pandemic and presence or absence of COVID-19 symptoms during the week that preceded the test. Gestational age was calculated according to the first day of the last menstrual period, or by the sonographic measurement of fetal biometric parameters when the gestational age given by ultrasound differed from that provided by the last menstrual period by more than one week.

To evaluate the context in which the tests were performed in the antenatal clinic, statistics concerning the daily number of cases in Australia and the state of Victoria were obtained from the Australian Government Department of Health website[10].

The primary outcome of the study was the proportion of pregnant women with a positive SARS-CoV-2 test. Continuous variables were assessed for normality by inspection of histograms and quantile-quantile (Q-Q) plots. Since the distributions of continuous baseline variables were not Gaussian, metric and ordinal variables were summarised as the median and interquartile range (IQR). Categorical variables were expressed as absolute number and percentage. The proportion of positive results was reported with its 95% confidence interval. Statistical analysis was performed in Stata version 16.1 (StataCorp. 2019. Stata Statistical Software: Release 16 for Macintosh. College Station, TX: StataCorp LLC).

Review of the screening results was approved by the local Human Research Ethics Committee (approval number QA/66029/MonH-2020-219471).

Results

Tests were performed from 6th to 19th May 2020, after a decline in the number of daily cases in Australia. The peak reporting of cases occurred on the 27th of March 2020 with 460 confirmed cases nationally and 111 cases in Victoria (Figure 1). Overall, 351 women consented SARS-CoV-2 testing. Of those, 332 (94.6%) were tested in antenatal clinic for routine screening and 19 (5.4%) were tested in the maternity ward, birth suite, pregnancy assessment unit, or the COVID-19 screening clinic due to possible symptoms of COVID-19. One patient (0.3%) in the routine screening group could not tolerate the test, and therefore 350 patients underwent testing.

The baseline characteristics of the screened population are summarised in Table 1. The median maternal age of the study population was 32 years (IQR 28 to 35 years). The median gestational age at testing was 33 weeks and four days (IQR 28 weeks to 36 weeks and two days), 148 women (42.2%) were nulliparous and 203 (57.8%) were parous. Ten women (2.9%) were in the first trimester (less than 14 weeks of gestational age), 77 (21.9%) were in the second trimester (from 14 to 28 weeks of gestational age), and 264 (75.2%) were in the third trimester of pregnancy (gestational age of 28 weeks or more).

In the routine screening group, two women (0.6%) reported possible COVID-19 symptoms in the days that preceded the test (one reported headache and one reported rhinorrhea). In the symptomatic group, the most common symptoms were fever (13, 68.4%), respiratory changes including cough and dyspnoea (5, 26.3%) and sore throat (4, 21%). No patients reported recent overseas travel or contact with known infected persons.

All 350 tests were negative for SARS-CoV-2, including those performed in women with symptoms. Using the statistical "rule of three" for approximation of the exact estimation for a binomial distribution with no events occurrence[11, 12], we estimate with 95% confidence that the true proportion of positive tests in the population is between 0 and 0.86% (p = 0%, 95% CI 0% to 0.86%).

Discussion

Main Findings

The severe acute respiratory syndrome coronavirus 2 is highly contagious. Each infected person is likely to infect on average, a measure known as R_0, between 2.2 and 5.7 individuals[13, 14], if measures to reduce transmission such as physical distancing and hands hygiene are not implemented. In this study, we report the results of SARS-CoV-2 testing of a large sample of pregnant women screened during antenatal care, and a smaller number of women who pursued testing due to symptoms of possible coronavirus infection. We found no positive tests in either group.

Strengths and Limitations

Our sample represents the population of pregnant women from a large geographical area in metropolitan Melbourne covered by catchments of our three maternity hospitals during a defined period in the constantly changing pandemic. The main limitation of this study is the fact that testing was performed on a limited number of mostly asymptomatic pregnant women as an opt in test, and at a single point in time. The results cannot be generalised to populations with higher rates of disease prevalence or to other age groups. Our sample did, however, include a group of women with potential symptoms of COVID-19, whose test results were negative. A single nasopharyngeal swab may potentially fail to identify a proportion of infected individuals[15], and it has been suggested that serial testing may be necessary to minimise false negative results[16]. These issues are, however, less problematic in low prevalence populations, in which the predictive value of a negative result is very high, reliably ruling infection out in asymptomatic individuals.

Interpretation

The findings of this study are reassuring and likely reflect a stage in the local pandemic context in which community transmission levels were very low, suggesting that widespread routine screening of asymptomatic pregnant women may not be necessary in the context of low community transmission. Under such circumstances, and since pregnant women are no more susceptible to infection than others[5, 6, 17], population prevalence estimates can reliably be extrapolated to pregnant women. What remains unknown is whether there is a threshold of community transmission when screening of asymptomatic pregnant women would be warranted given their unique situation of needing to attend hospital repeatedly for antenatal care and for delivery.

Identifying pregnant women who carry the virus is important to allow for treatment of symptomatic individuals, physical isolation of carriers, contact tracing, and implementation of correct PPE to reduce transmission risk during antenatal consultations, laboratory testing, ultrasound examinations and during birth that may involve an aerosol generating procedure such as maternal effort in the second stage of labour or endotracheal intubation for general anaesthesia (if required) during caesarean deliveries. Indeed, a similar universal screening study performed in New York City examined 215 pregnant women admitted at the time of labour and found that 15.4% of them had a positive result, of whom nearly 88% (29 of 33 with a positive test) were asymptomatic[18]. At that time, the number of reported cases in New York ranged from five to over eleven thousand per day[1]. In a similar smaller study in Japan, 52 obstetric patients admitted to the hospital were tested with PCR, and two (3.8%) had positive results without any symptoms[19]. The differences observed between the studies can be explained by the diverse regional prevalence of the disease, with much higher asymptomatic community transmission levels in some areas of the United States at the time.

In Australia, mitigation measures such as the closure of the borders and restriction rules were implemented relatively early in the pandemic. The early introduction of these measures likely explains the lower prevalence and fatality rates than most other high-income countries. Indeed, of all tests performed in Victoria since the beginning of the pandemic, only 0.3% were positive[10]. It is likely that the real positivity (prevalence) rates are even lower because community testing has been focussed on those with symptoms, albeit with a progressively lowering threshold for those symptoms. In the state of Victoria, there are currently 290 diagnosed active cases and an estimated 964 undiagnosed cases due to imperfect detection or absence of symptoms, according to a model available online, at the time this report was written[1]. Considering a state population of 6.63 million inhabitants[20], the prevalence rate of the infection is estimated at 189 infections per one million inhabitants. Notwithstanding, the fear of a possible second wave has been constant, and the interpretation of the epidemiology will need to be revisited as the prevalence and the community transmission rates change with the dynamics of the pandemic.

Universal testing has been proposed not only to reduce transmission rates and avoid an overload of the health systems but also as an alternative strategy to reduce economic and social damage during relaxation of restriction measures, with strict household quarantine after a positive test[16]. Feasibility, cost and effectiveness of such policy have not, however, been evaluated. In addition, it is unlikely that one single strategy will be enough to assuage the disease burden. Instead, it is the combination of different effective measures that will be able to mitigate the enormous consequences of the pandemic[2, 3].

Conclusion

The prevalence of asymptomatic coronavirus infection among pregnant women during low community transmission periods is negligible. While screening reliably rules out the disease in low prevalence populations, the costs, harms and benefits of universal screening need to be carefully weighed considering the dynamic global picture of the pandemic in different scenarios.

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Ethics approval

This study was approved by the local Human Research Ethics Committee (approval number QA/66029/MonH-2020-219471).

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Table

Table 1. Baseline characteristics of the screened population (N = 351).

Age (years)	32.0 (28.0 to 35.0)
Weight (Kg)	68.0 (58.0 to 82.0)
Height (cm)	163.0 (158.0 to 167.0)
BMI (Kg/m^2)	25.9 (22.3 to 30.9)
Gestational age (weeks + days)	33+4 (28+0 to 36+2)
Parity	
Nulliparous	148 (42.2)
Parous	203 (57.8)
Region of birth, n (%)	
Australia / New Zealand	181 (51.6)
Pacific Islands	9 (2.5)
East Asia	44 (12.5)
Southeast Asia	10 (2.9)
South Asia	76 (21.6)
North Africa	3 (0.9)
West Africa	1 (0.3)
East Africa	8 (2.3)
Middle East	5 (1.4)
Europe	11 (3.1)
North America	1 (0.3)
South America	2 (0.6)
Indigenous status	7 (2.0)

Continuous variables given as the median (interquartile range), and categorical variables given as number (percentage).

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